CLAIMS

We claim:

1. A semiconductor package, comprising:

a die containing a bond pad;

a leadframe containing a plurality of leads;

a plurality of bump structures between the die and the leadframe, the bump structures contain a metal stud with substantially no Pb; and

a molding material encapsulating the plurality of bump structures and the side of the die containing the bond pad.

2. The package of claim 1, wherein the plurality of bump structures couples the die to the leadframe.

3. The package of claim 1, wherein the bump structures also contain a solder paste.

4. The package of claim 3, wherein the solder paste is located on a solderable area of the leadframe.

5. The package of claim 4, wherein the solderable area comprises a pad comprising a non-oxidizable metal.

6. The package of claim 5, wherein the non-oxidizable metal is a noble metal.

7. The package of claim 4, wherein the leadframe also contains a solder dam surrounding the solderable area.

8. The package of claim 7, wherein the solder dam comprises a metal oxide material.

9. The package of claim 8, wherein the metal of the metal oxide material is the same as or different from a metal used in the leadframe.

10. The package of claim 7, wherein the solder dam comprises a polymeric material.

11. The package of claim 1, wherein the molding material also encapsulates the region of the leadframe connected to the bump structures.

12. The package of claim 11, wherein an exterior surface of the molding material is substantially co-planar with the side of the die opposite the bond pad.

13. The package of claim 1, wherein the amount of Pb in the metal stud is less than about 1ppm.

14. A semiconductor package, comprising:

a die containing a bond pad;

a leadframe containing a plurality of leads;

a plurality of bump structures between the die and the leadframe, the bump structures containing a metal stud with less than about 1 ppm Pb; and

a molding material encapsulating the plurality of bump structures and the side of the die containing the bond pad.

15. The package of claim 14, wherein the metal stud of the bump structures is located on a solderable area of the leadframe.

16. The package of claim 14, wherein the solderable area comprises a pad containing a noble metal.

17. The package of claim 16, wherein the leadframe also contains a solder dam surrounding the solderable area, the solder dam comprising a metal oxide or polymeric material.

18. A system containing a semiconductor package, the package comprising:

a die containing a bond pad;

a leadframe containing a plurality of leads;

a plurality of bump structures between the die and the leadframe, the bump structures containing a metal study with substantially no Pb; and

a molding material encapsulating the plurality of bump structures and the side of the die containing the bond pad.

19. An electronic apparatus, comprising:

a semiconductor package containing:

a die containing a bond pad;

a leadframe containing a plurality of leads;

a plurality of bump structures between the die and the leadframe, the bump structures containing a metal stud with substantially no Pb; and

a molding material encapsulating the plurality of bump structures and the side of the die containing the bond pad; and

a circuit board.

20. A method for making a semiconductor package, the method comprising:

providing a die containing a bond pad;

providing a leadframe containing a plurality of leads;

providing a plurality of bump structures between the die and the leadframe, the bump structures containing a metal stud with substantially no Pb; and

providing a molding material encapsulating the plurality of bump structures and the side of the die containing the bond pad.

21. The method of claim 20, including further providing the bump structures so that the metal stud is located on the bond pad.

22. The method of claim 20, including providing the solderable area with a pad containing a noble metal.

23. The method of claim 22, including providing the leadframe with a solder dam surrounding the solderable area, the solder dam comprising a metal oxide or polymeric material.

24. A method for forming a semiconductor package, the method comprising:

providing a die with a metal stud on a bond pad;

providing a leadframe containing a plurality of leads, the leadframe containing a solderable area surrounded by a solder dam;

providing a solder paste in or on the solderable area;

attaching the die and the leadframe; and

molding a molding material around a portion of the die and a portion of the leadframe.

25. The method of claim 24, wherein the metal stud contains substantially no Pb.

26. The method of claim 25, wherein the amount of Pb in the metal stud is less than about 1 ppm.

27. The method of claim 24, including attaching the die to the leadframe by flipping the die and contacting the metal stud with the solder paste.

28. The method of claim 24, wherein the solderable area contains a pad comprising a non-oxidizable metal.

29. The method of claim 28, wherein the solder dam comprises a metal oxide or polymer material.

30. The method of claim 29, including providing the metal oxide material by providing a metal and then oxidizing the metal.

31. The method of claim 29, including providing the polymeric material by screen printing.

32. The method of claim 24, including molding by using a film assisted molding process.

33. The method of claim 24, further including re-flowing the solder paste after attaching the die and the leadframe.

34. A method for forming a semiconductor package, the method comprising:

providing a die with a metal stud on a bond pad, the stud bump containing substantially no Pb;

providing a leadframe containing a plurality of leads, the leadframe containing a solderable area surrounded by a solder dam;

providing a solder paste on the solderable area;

attaching the die and the leadframe by contacting the metal stud with the solder paste; and

molding a molding material around a portion of the die and a portion of the leadframe.

35. The method of claim 34, wherein the amount of Pb in the metal stud is less than about 1 ppm.

36. The method of claim 24, wherein the solderable area contains a pad comprising a non-oxidizable metal and the solder dam comprises a metal oxide or polymer material.

37. The method of claim 36, including providing the metal oxide material by providing a metal and then oxidizing the metal.

38. The method of claim 24, further including re-flowing the solder paste after attaching the die and the leadframe.

39. A method for making an electronic apparatus, comprising:

providing a semiconductor package containing:

a die containing a bond pad;

a leadframe containing a plurality of leads;

a plurality of bump structures between the die and the leadframe, the bump structures containing a metal study with substantially no Pb; and

a molding material encapsulating the plurality of bump structures and the side of the die containing the bond pad;

providing a circuit board; and

connecting the semiconductor package to the circuit board.